ABSTRACT

An apparatus and method to detect and control the combustion quality of a lean burn reciprocating engine using ionization signals is presented. The system receives a succession of ionization signals for successive cycles of a running engine and processes a plurality of related ionization signals for signal stability. A start point and peak of the ionization signal is identified, using an initial current level for all of the signals. A geometric parameter is associated with the ionization signal that relates the start point to the peak. The geometric parameter is compared against a reference geometric parameter related to a desired combustion quality relating to a lambda greater than 1.4. A control parameter of the engine is adjusted such that an error difference between the geometric parameter and the reference geometric parameter is minimized. The ionization signals are checked to determine if an abnormal combustion condition such as knock or misfire has occurred.